GSC Advanced Research and Reviews

eISSN: 2582-4597 CODEN (USA): GARRC2

Cross Ref DOI: 10.30574/gscarr

Journal homepage: https://gsconlinepress.com/journals/gscarr/

(RESEARCH ARTICLE)

Check for updates

# Food consumption and plate waste study in a public hospital food service in Natal, RN, Brazil

Bruno Jonatan de Sousa [1, *], Carla Cristina Monteiro [2], Valtêmia Porpino Gomes Costa [3], Thaís Araújo de Medeiros Borges [4] and Paula Angela Bessa Freitas de Oliva [4]

[1] *Food Science and Technology Specialist. Centro Universitário do Rio Grande do Norte (UNI-RN), Natal, RN, Brazil.*
[2] *Nutrition Undergraduate Program – UNI-RN, Natal, RN, Brazil.*
[3] *Dietitian at Maternidade Escola Januário Cicco / Federal University of Rio Grande do Norte (MEJC/UFRN), Natal, RN, Brazil.*
[4] *Food Service Dietitian at Monsenhor Walfredo Gurgel Hospital, Natal, RN, Brazil.*

GSC Advanced Research and Reviews, 2022, 11(03), 056–065

Publication history: Received on 04 May 2022; revised on 10 June 2022; accepted on 12 June 2022

Article DOI: https://doi.org/10.30574/gscarr.2022.11.3.0153

## Abstract

Aiming to better understand the food waste and eating habits of diners, this study determined, by sex, food consumption and plate waste in the lunch meal served to employees at a public hospital in Natal, RN, Brazil, during one week. Men consumed 34% more than women did. The average consumption of the week by men and women was 469 g. Women wasted, on average, 9% of what they placed on their plates, or 39 g per day. Men wasted, on average, 5% of what they placed on their plates, discarding 34 grams of food per day. According to these results, women wasted 4% more than men did. The average PW% of the week was of 7.7% (37 g per capita per day). The food wasted during the 5 days of distribution would have been enough to serve lunch to a total of 122 diners. The data here provided are useful for several reasons, as this study may be used as reference to evaluate food waste more accurately in the food service, to elaborate educational material to create awareness among diners and food service professionals, and to estimate the financial impact of food waste on the budget. One of the highlights of this study is the provision of data on the consumption and plate waste (% and in grams) not only by the whole population studied, but discriminated considering women and men, which is not the most conventional way presented by studies.

**Keywords:** Plate Waste; Food Consumption; Hospital Food Service; Brazil

## 1. Introduction

Food loss and waste (FLW) refers to a decrease, at all stages of the food chain from harvest to consumption in mass, of food that was originally intended for human consumption, regardless of the cause [1,2]. In food and beverage operations, waste happens during the whole production process, starting from food items acquisition, storage, preparation, rigorous use of specific equipment and materials, effective training of food operators, cooking, distribution and finally during consumer acceptance [3].

Consumers have more and more often considered food waste when choosing a restaurant. A study by Unilever revealed that 72% of U.S. diners care about how restaurants handle food waste, and 47% would be willing to spend more to eat at a restaurant with an active food recovery program [4].

* Corresponding author: Bruno Jonatan de Sousa; E-mail: brunonutri@hotmail.com
Food Science and Technology Specialist. Centro Universitário do Rio Grande do Norte (UNI-RN), Natal, RN, Brazil.

### 1.1 Food waste in the world

According to FAO, it is estimated that each year approximately 1.3 billion tons of food are lost in the world. This means more than 30% of all world food production and 15% of all calories produced. Besides that, 6 billion tons of agricultural products (include animal food) are produced per year [1,2,5].

According to FAO, when there is food loss there is a reduction in the availability of food for human consumption along the food supply chain, especially in the production, post-harvest and processing phases. It is estimated that 54% of the food waste in the world occurs in those phases, what represents a more significant challenge to developing countries, where 33% of the food losses happen in the agricultural production. Processing, distribution and consumption are responsible for the remaining 46% of the losses, being more observed in more industrialized regions or where there is a higher average income [1,6]. In low-income countries, food is lost mostly during the early and middle stages of the food supply chain; much less food is wasted at the consumer level [7].

### 1.2 Food waste in Brazil and economy

In Brazil, there are five social classes, referred to by letters (A, B, C, D, E), with different incomes and characteristics. What is known as "middle class" in Brazil is different in several ways when compared to the US or Europe. Much has been commented on the rising of 40 million Brazilians to a new low middle class, with a huge impact on domestic consumption. In an economy with rapid and unpredictable changes, the impacts on inflation and food prices pose an additional challenge to understand consumer behaviors and their effects on food production and consumption [8].

In modern societies, the challenges imposed by long commuting and long work hours are an obstacle for a large number of people to have their meals in their households. For them, the only feasible alternative is to eat in a food service establishment [9].

In Brazil, 60% of the food production is lost before reaching the diner's plate. This represents 39,000 tons of food converted to garbage per day, which would be enough food to feed 19 million people, considering the three main meals of the day. Economically speaking, Brazil wastes annually the equivalent to 12 billion BRL in food, and statistics show that every person wastes an average of 150 grams of food per day, which means 55 kilograms per person per year [10,11].

Creus [12] verifies a scenario where the agricultural sector in Brazil suffers an impact from the economic instability that generates a higher concern about inflation, which leads to hunger and agricultural losses; the agricultural market, which expands nationally and internationally, has been growing, but so has the population. However, hunger and food losses are still problems to be dealt with.

Brazil's Technical Committee on Food Loss and Waste (TC FLW) approved in November 2017 the Intersectoral Strategy for the Reduction of Food Loss and Waste in Brazil [1] with lines of action on Research, Knowledge and Innovation; Communication, Education and Training; Promotion of Public Policies; and Legislation.

### 1.3 Plate waste, interferences, and strategies

Several quality indicators are used to measure the acceptance of meals in food services, being plate waste percentage (PW%) and leftovers assessment two of the most efficient, once they establish a relation between the waste and the quantity and quality of the dishes offered [13].

Plate waste is the organic leftovers of food that return on a diner's plate, excluding fruit peels, bones, and other nonedible parts, and it is an indicator of food waste in restaurants where food has been served, but not fully ingested [14].

Given both individual and day-to-day variations in appetite and energy needs and in tastes and preferences, it is unreasonable to expect that plate waste could be completely eliminated in any foodservice setting [15]. In hospitals and other healthcare facilities, where plate waste is higher than other foodservice sectors, food waste can range from 6% to 65% [16].

A very high plate waste percentage can be explained by high frequency of the same dish in the menu, food dishes that are incompatible with the eating habits of the diners or client standards, planning failures on the number of meals and per capita amount, bad appearance or unpleasant display of the food dishes, serving size mistakes during distribution,

use of inadequate silverware to serve, and the memory of having had a food item previously and not having liked it [14,17].

Education campaigns are important to control and reduce the plate waste, and the size of the plate or the number and/or size of the receptacles may influence diners to place an amount of food that is larger than what they might be able to ingest, which leads to more plate waste. Plate waste percentages (PW%) considered acceptable vary from 2% to 5% of the amount of food served, or 15 g to 45 g per person [14,18]. Kantor et al. [19] estimated that food waste at the commercial foodservice and household level accounted for 26 percent of edible food supplies.

A study on food psychology found that consumers given larger bowls took 16% more than those with smaller bowls did. Because consumers generally find a 70% fill rate to be "visually pleasing," smaller plates can reduce the amount of food consumers serve themselves and prevent unnecessary post-consumer food waste. Research also shows that the average child eats only about 60% of what he or she serves themselves (far less than adults), meaning that smaller plates are even more important for children [20–23].

In 'pay-by-weight' restaurants, common in Brazil and Portugal, there is an economic incentive for consumers 'not to waste', and to adjust the size of the meal to their real needs, not more, as what gets wasted could have been saved in terms of meal cost, making 'waste reduction' behavior a means to optimize meal costs [2].

Here are some of the strategies on the implementation of the USDA Healthy, Hunger-Free Kids Act listed to minimize plate waste in schools: obtain feedback on new menu items, implement the Offer versus Serve option across all grade levels, provide more choices, serve foods with familiar flavors, serve ready-to-eat fruit, invite school staff and teachers to eat meals with students, reward students for trying new foods, encourage principals to schedule recess before lunch, encourage students to keep food items for snacks, offer grab-and-go items, serve breakfast in the classroom, offer sharing/trading tables, and donate intact items to food banks [24].

### *Objectives of the research*

Aiming to better understand the food waste and eating habits of diners, this study determined, by sex, food consumption and plate waste in the lunch meal served to employees at a public hospital in Natal, RN, Brazil, during one week.

## 2. Methods

### 2.1 Research site

This research was conducted in the cafeteria of a public hospital in the city of Natal, in the Brazilian state of Rio Grande do Norte, which produces approximately 3,000 (three thousand) meals per day. The meals served are breakfast, morning snack, lunch, afternoon snack, dinner, and night snack. From the 3,000 meals, 2,300 are produced to patients and patient-accompanying persons, and the remaining 700 meals are served to the hospital's employees in the cafeteria.

### 2.2 Research period, data collection, menu description and photographic record

**Week Menu Description and Photographic Record**

| Day 1 (Fish) | Day 2 (C. Thigh) | Day 3 (Beef Loin) | Day 4 (Beef Stew) | Day 5 (C. Breast) |
|---|---|---|---|---|
|  |  |  |  |  |
| Rice, mashed potatoes, corn couscous, black beans with jerked beef, and baked fish steak (*Salminus brasiliensis*) to the coconut sauce. | Cooked vegetable salad (beets, carrots, peas, corn, and eggplant), rice with green beans and corn, *farofa* (toasted cassava flour with textured soy protein), black beans, and roasted chicken thigh with drumstick. | Shredded raw vegetable salad (lettuce, red cabbage, carrots, chard, and beets), turmeric rice, beans mixed with cassava flour and sautéed meats, beef loin filled with carrots. | Cooked vegetable salad (sweet potatoes, cassava root, pumpkin, and sautéed collard greens), white rice, beef stock cassava flour puree, black beans, and beef/rib stew. | Vegetable salad (cooked beets, tomatoes and onions), rice, corn couscous, white beans, and oven baked chicken. |

**Figure 1** Week menu description and photographic record

The research period was chosen after analyzing the 6-Month Lunch Menu and considering the regular meal dishes more often served. These were the codes created to represent the dishes served respectively from April 22nd to April 26th, 2013: Day 1 – Fish; Day 2 – C. Thigh; Day 3 – Beef Loin; Day 4 – Beef Stew; Day 5 – C. Breast. Figure 1 contains photos and description of the dishes selected for this study.

### 2.3 Sample frame

The participants of this research were the health professionals of a public hospital who had their lunch meals served at the hospital's cafeteria. In Table 1 are the numbers and sex of participants in the different days of the data collection. Due to employees' schedules, diners were not necessarily the same in the different days of the week (for instance, a nurse may have worked on Days 1, 3, and 5, and may have been replaced by someone else on Days 2 and 4).

**Table 1** Number and sex of diners per study day

| Number and sex of diners per study day | | | | | | |
|---|---|---|---|---|---|---|
| **Diners** | **Day 1 (Fish)** | **Day 2 (C. Thigh)** | **Day 3 (Beef Loin)** | **Day 4 (Beef Stew)** | **Day 5 (C. Breast)** | **Total n (%)** |
| Women | 137 | 231 | 195 | 206 | 210 | 979 (67%) |
| Men | 76 | 92 | 115 | 91 | 119 | 493 (33%) |
| Total | 213 | 323 | 310 | 297 | 329 | 1472 |

We evaluated how much food was placed on plate, consumed and wasted in 1,472 meals served to employees of the hospital where the study was conducted. Approximately two-thirds of the participants were women (67%) and one-third were men (33%).

### 2.4 Weighing

In this research, the diners stood in line in the hospital's cafeteria and served themselves freely of all food dishes available, being only the meat/chicken/fish serving controlled (by a food handler), as usually happens in this distribution setting. After serving, the plate of each diner was weighed distinguishing men's from women's plates. At the end of their meal, each diner brought their plates with organic waste, which was collected inside appropriate receptacles (one for men's waste and another for women's waste) to be weighed afterwards. All the weighing procedures were conducted using a Urano US 15/5 POP-S Scale, which had a 5-grams accuracy and carried an INMETRO Verification Certificate. Some studies [13,15] described this method as the Physical Measurement of Plate Waste.

To reach this research's objectives, some previous data collections were necessary for a better data control, such as the determining of the average weight of the plates used in the cafeteria and the identification of the average weight of the nonedible parts of the food served, which were bones of the beef/ribs and chicken, and fishbone.

#### *2.4.1 Determining the average weight of the plates used in the cafeteria*

In the cafeteria, only one type of plate was used, but they were known to vary in their weight. We decided not to weigh each plate before the participants started serving themselves in the food island due to the fact that this step could interfere in the way the diners would serve themselves, possibly making them apprehensive. That being said, to make possible the quantifying of the food placed on the plate by each diner, the average weight of plates was identified through the weighing of 20 plates randomly selected.

The plates varied from 613 g to 735g (613, 651, 652, 656, 666, 669, 670, 672, 682, 682, 685, 691, 693, 699, 702, 706, 708, 708, 719, and 735). Therefore, the empty plates had an average weight of 682.95 g.

#### *2.4.2 Identifying the average weight of the nonedible parts*

Facing the need to differentiate the organic waste from its nonedible parts, the average weight of the bones was determined in each day of the data collection days. The only day of the data collection in which the determination was not necessary was the third one (Day 3 – B. Loin), since in the menu for that day there were no nonedible parts.

To identify the average weight of the nonedible parts of the dishes, bones and fishbone were collected in each day from 30 (thirty) diners, before they threw the organic waste in the receptacle. After the bones and fishbone were collected,

the edible parts attached to them, if any, were removed, and only then the bones were weighed, and their average weight identified. Bones and fishbone were returned to the receptacles after weighed.

For identifying the average weight of the chicken thighs' and drumsticks' bones specifically, 30 (thirty) thighbones and 30 (thirty) drumstick bones were collected, and the number of serving of both. The weight found for the chicken thighbones was then multiplied by the number of servings of thighs served in the day, which led to the total weight of bones contained in the organic waste. The same procedure was done to identify the chicken drumstick bones.

The values found were: Day 1 (Fish) = 12.50 g; Day 2 (C. Thigh) = 36.67 g; Day 3 (Beef Loin) = 0.00; Day 4 (Beef Stew) = 40.00; Day 5 (C. Breast) = 23.33.

### 2.5 Plate waste and consumption evaluation

To identify the amount of food ingested by the diners, the weights of the food placed on the plate by men and women were registered separately and out of those results decreased the organic waste (at this moment the weight of the bones should remain in the equation as part of the organic waste).

- Ingested food = (Food placed on plate – Organic waste) ÷ Number of diners

The plate waste for men and women, on the other hand, was obtained through the relation between the food placed on the plates and the organic waste, decreasing, from both, the nonedible parts. In this way, the Plate Waste Percentage (PW%) was identified through the equation below:

- PW% = [(Organic waste – Weight of bones) ÷ Edible part placed on plate] × 100, Or,
- PW% = (Edible part discarded ÷ Edible part placed on plate) × 100

## 3. Results and discussion

Based on the food consumption results (Figure 2), men ingested a larger amount of food than women did in all days of this study. The lowest average amount of food ingested by women was 296 g on the third day, when men also ingested the lowest (478 g). The lower consumption on the third day may be related to the density of the shredded vegetable salad of which the volume is considerable, but the weight is inferior to cooked (boiled, steamed, etc.) vegetable salads. Besides that, the beans on the third day did not contain broth, therefore reducing its density.

The day on which women and man ingested the most was the fourth day, with a consumption of, respectively, 472 g and 703 g. On that day, a typical beef/rib stew was served with a cassava flour puree called '*pirão'*, in Portuguese, and made with the stock of the stew. There were also black beans on the menu, which are served integrating grains and broth. We raised the hypothesis that these 'dense' dishes were responsible for the higher consumption on the third day, however, we also considered the fact that this day's menu was the most culturally attractive due to the presence of typical dishes (the beef/rib stew and the *pirão*).

On average, on the 5 days, women consumed 402 g, and men consumed 605 g, which represents a consumption by men one-third higher (34%) than by women. Considering that 67% of the diners were women and 33% were men, the average consumption per capita of the week was 496 g.

In the food waste evaluation in the distribution of lunch to hospital employees in Porto Alegre, RS, Müller and Oliveira [25] found 453.37 g and 462.28 g as the average ingestion in the first and second evaluation, respectively, being 42.6 g and 33.7 g inferior to the week average consumption on our study (496 g). The average results found for the population studied by Rabelo and Alves [13] was of 822 g per capita, and considering the results of their study, the food waste cost monthly 18,370.00 BRL.

The PW% results (Figure 3) show that the days on which there was higher food waste were the Days 1 and 5, with a percentage of 11% for women and 6% for men on both days. The day on which the lowest food waste was observed was the fourth day, with 4% for women and 2% for men. It is worth mentioning that the fourth day was also the one with the highest consumption by both women and men, which supports our hypothesis that typical dishes on the menu effected diners' consumption.

Considering the number of women and men, the average PW% of the week was 7.7%. The average PW% for women during the five days was 9%, thus, 4% higher than average PW% for men, which was 5%. Such findings show that, although women placed 34% less food in their places, they did waste more food than men did.

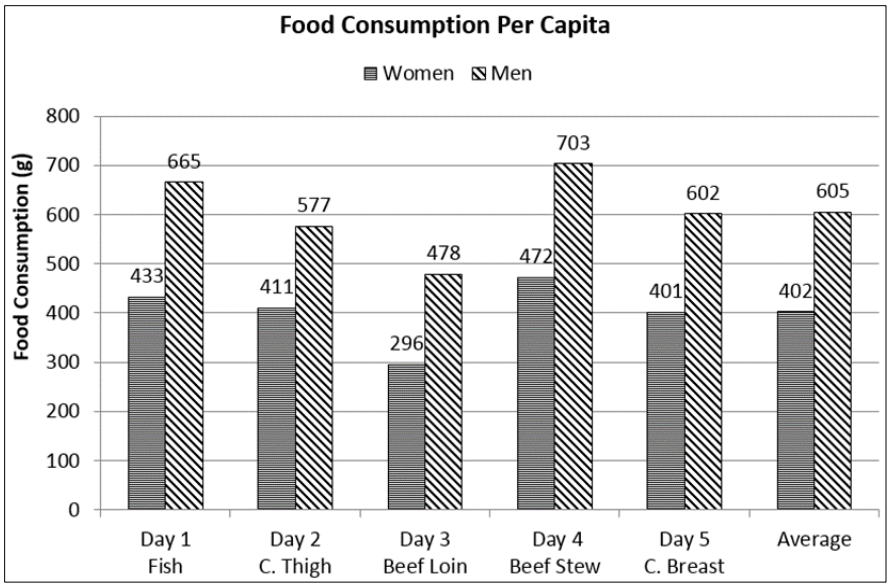


**Figure 2** Food consumption per capita by women and men

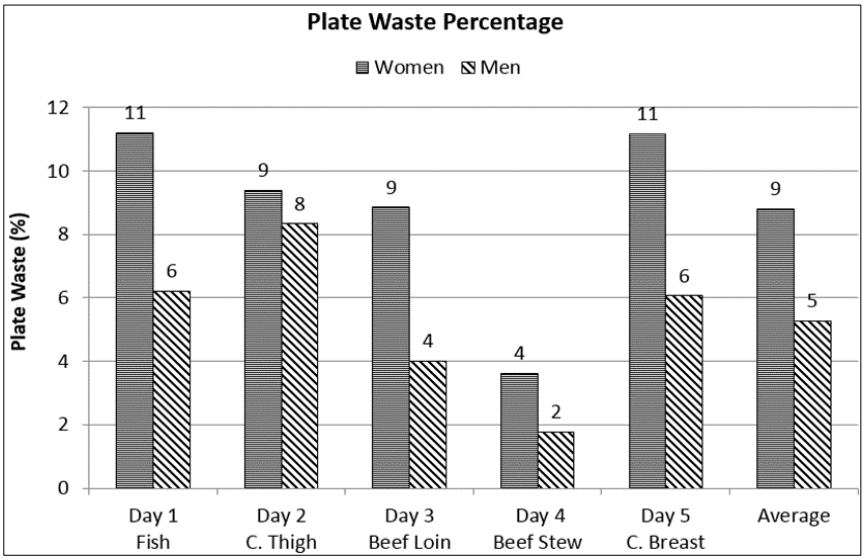


**Figure 3** Plate waste percentage (PW%) by women and men

An average PW% higher than 2% - 5% is considered acceptable by Vaz [14], although when comparing his per capita PW% reference in grams, the average result is below the maximum of 45 grams established by the same author. In addition, some studies consider a PW% inferior to 10% as being adequate.

The average edible food discarded from the plates by women was 39 g, and by men, it was 34 g (Figure 4). The average plate waste per capita of the week was 37 g.

Having a PW% of 7.7%, and knowing that a total of 1,472 diners had their meals on the 5 days of distribution, we estimated that the food wasted during the 5 days would have been enough to feed lunch to a total of 122 diners.

In the Table 2, the PW results (expressed both in % and grams) of this study are compared to other PW studies. The differences show how peculiar each food service and clientele are, and how important it is to conduct research on food

waste so that the results found in one food service may be used as reference by its team and help to set more efficient interventions for raising awareness on food waste and, consequently, improvements on such parameter.

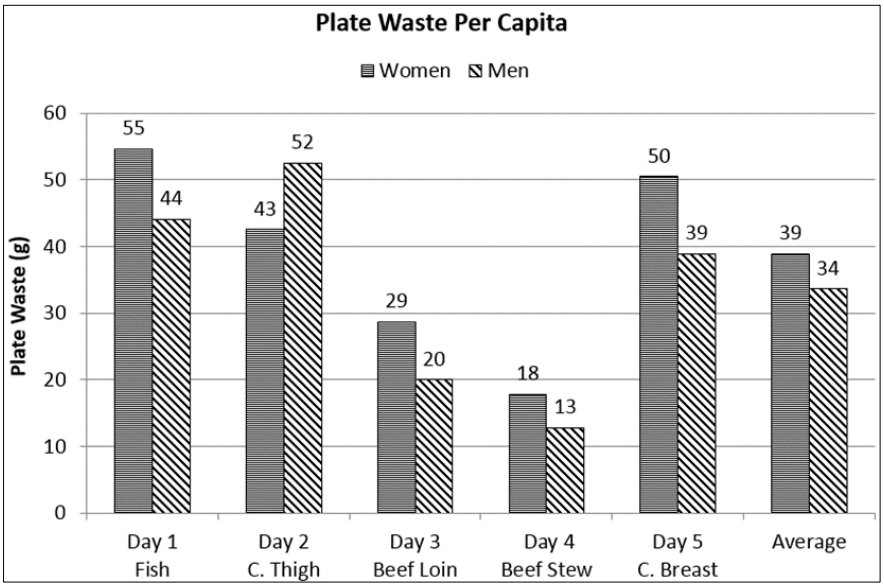


**Figure 4** Plate waste per capita by women and men

**Table 2** Comparison of our results to other plate waste studies from various settings

| Plate Waste Studies | | |
|---|---|---|
| **Study** | **Plate waste (%)** | **Plate waste per capita (g)** |
| Müller and Oliveira, 2008 [25] | 7.89 | 39.00 |
| | 6.72 | 33.33 |
| Augustini et al., 2008 [26] | 5.83 | 40.00 |
| Moura, Honaiser, and Bolognini, 2009 [27] | 11.17 | 58.44 |
| Amorim and Gatti, 2010 [28] | 12.68 | 80.85 |
| Mello et al., 2011 [29] | 8.42 | 70.80 |
| Rabelo and Alves, 2016 [13] | 9.45 | 77.82 |
| Aranha and Gustavo, 2018 [30] | 8.73 | 50.00 |
| This study | 7.70 | 37.00 |

Müller and Oliveira [25] observed percentages (7.89% and 6.72%) relatively close to the ones found in our study (7.70%). In the study conducted by Amorim and Gatti [28], the PW% was identified as 12.68%, with 80.85 grams of plate waste per person. For Amorim, there was repetition of food options, because during the study, canned meats, which were not well accepted by dinners, were served three times during the 7-day data collection. For him, the poor presentation of the food was also a factor that contributed to the PW results. In the study conducted by Mello et al. [29], the results were associated with planning errors and low qualification of the food service personnel.

At the hospital food service studied in our research, average plate waste was within, or often inferior to, results of several studies conducted in various institutional services (Table 2).

One of the highlights of this study is the provision of data on the consumption and plate waste (% and in grams) not only by the whole population studied, but discriminated considering women and men, which is not the most conventional way presented by studies.

## 4. Conclusion

Here are the main findings of our study (average values per capita per day):

- The average consumption was 469 g (women = 402 g; men = 605 g).
- Men consumed 34% more (203 g) than women did.
- The average PW% of the week was of 7.7% (37 g).
- Women wasted 9% (39 g) of what they placed on their plates.
- Men wasted 5% (34 g) of what they placed on their plates.
- Although women placed less food on their plates, they wasted 4% more than men did.
- The food wasted during the 5 days would have been enough to serve lunch to a total of 122 diners.

The data here provided are useful for several reasons, as they may be used: 1) as reference to evaluate more accurately food waste in the food service, 2) to elaborate educational material to raise awareness among diners and food service professionals, and 3) to estimate the financial impact of food waste on the budget.

Sensitizing the team, managers, and most importantly, the diners, about the impact of food losses and food waste may improve the statistics found in this study. Actions such as campaigns against food waste, lectures, use of visual aids in the cafeteria, and even competitions may help to raise awareness about this matter.

## Compliance with ethical standards

*Acknowledgments*

We are grateful to the Nutrition Undergraduate Program at *Centro Universitário do Rio Grande* (UNI-RN) and to the food service team at the Monsenhor Walfredo Gurgel Hospital.

*Disclosure of conflict of interest*

We, the authors, declare no conflicts of interest regarding this study's development or publication.

## References

[1] CAISAN (Interministerial Chamber for Food and Nutrition Security). Resolution N.1, of April 17, 2018 [Internet]. Ministry of Social Development; 2018 p. 1–40. Available from: https://www.mds.gov.br/webarquivos/arquivo/seguranca_alimentar/caisan/Publicacao/Caisan_Nacional/PDA_ingles.pdf

[2] HLPE (High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food S. Food losses and waste in the context of sustainable food systems [Internet]. Rome, Italy; 2014. Available from: https://www.fao.org/3/i3901e/i3901e.pdf

[3] Ferreira M, Liz Martins M, Rocha A. Food waste as an index of foodservice quality. Br Food J [Internet]. 2013 Oct 21;115(11):1628–37. Available from: https://www.emerald.com/insight/content/doi/10.1108/BFJ-03-2012-0051/full/html

[4] Unilever Food Solutions. World Menu Report Global Research Findings. 2011(Figure 2, pp.6; Figure 3, 7). Available from: https://issuu.com/unileverfoodsolutions/docs/32369_foodso_ufs_wmr_12pages_uk__vf

[5] FAO (Food and Agriculture Organization of the United Nations). Working document: Food Wastage Footprint - impact on natural resources [Internet]. Technical Report - FAO. 2013. Available from: https://www.fao.org/3/i3347e/i3347e.pdf

[6] Peixoto M, Pinto HS. Boletim Legislativo Nº 41, de 2016 - Desperdício de Alimentos: questões socioambientais, econômicas e regulatórias. [Internet]. Brasília, DF, Brasil; 2016. Available from: https://www2.senado.leg.br/bdsf/bitstream/handle/id/517763/boletim_41_MarcusPeixoto_HenriqueSallesPinto.pdf?sequence=1&isAllowed=y

[7] FAO (Food and Agriculture Organization of the United Nations). Global food losses and food waste – Extent, causes and prevention [Internet]. Rome, Italy; 2011. Available from: https://www.fao.org/3/i2697e/i2697e.pdf

[8] Henz GP, Porpino G. Food losses and waste: how Brazil is facing this global challenge? Hortic Bras [Internet]. 2017 Oct;35(4):472–82. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-05362017000400472&lng=en&tlng=en

[9] Viana RM, Ferreira LC. Avaliação do desperdício de alimentos em unidade de alimentação e nutrição cidade de Januária, MG. Hig Aliment [Internet]. 2017;31(266/267):1–5. Available from: https://docs.bvsalud.org/biblioref/2017/05/833306/266-267-site-22-26.pdf

[10] Edington, I. et al. Do campo a cidade: soluções para o desperdício de alimentos. EcoD - Espec Meio Ambient [Internet]. 2013;1:1–30. Available from: https://issuu.com/ecod/docs/especial_meio_ambiente__1_

[11] Rodriguez AC, Figueiredo F, Bautitz S, Horn V, Pinto CL de S, Freiberg CK, et al. Análise do índice de Resto-ingestão e de Sobras de uma UAN localizada no município de São Paulo, SP. Hig Aliment [Internet]. 2010;24(184/185):22–4. Available from: https://higienealimentar.com.br/wp-content/uploads/2019/07/REVISTA-184-185.pdf

[12] Creus AC. Prevenção do desperdício alimentar sob a avaliação de ciclo de vida: ferramenta e aplicação em casos práticos [Internet]. UFRJ/COPPE. Universidade Federal do Rio de Janeiro; 2018. Available from: https://pantheon.ufrj.br/bitstream/11422/12260/1/AlbaCanovasCreus-min.pdf

[13] Rabelo NDML, Alves TCU. AVALIAÇÃO DO PERCENTUAL DE RESTO-INGESTÃO E SOBRA ALIMENTAR EM UMA UNIDADE DE ALIMENTAÇÃO E NUTRIÇÃO INSTITUCIONAL. Rev Bras Tecnol Agroindustrial [Internet]. 2016 Jun 30;10(1):2039–52. Available from: https://periodicos.utfpr.edu.br/rbta/article/view/1808

[14] Vaz CS. Restaurantes: controlando custos e aumentando lucros. Brasília, DF, Brasil: Celia Vaz; 2006. 193 p.

[15] Buzby JC, Guthrie JF. Plate Waste in School Nutrition Programs: Final Report to Congress. [Internet]. 2002. Available from: https://naldc.nal.usda.gov/download/48204/PDF

[16] Williams P, Walton K. Plate waste in hospitals and strategies for change. E Spen Eur E J Clin Nutr Metab [Internet]. 2011 Dec;6(6):e235–41. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1751499111000588

[17] Chemah TC, Nur Adilah Z, Sabaianah B, Zurinawati M, Aslinda Mohd S. Plate Waste in Public Hospitals Foodservice Management in Selangor, Malaysia. Indian J Sci Technol [Internet]. 2018 Sep 1;11(36):1–5. Available from: http://www.indjst.org/index.php/indjst/article/view/98468

[18] Vaz CS. Alimentação de coletividade: uma abordagem gerencial. [Internet]. 2nd ed. Brasília, DF, Brasil: CIR - Biblioteca - Centro de Informação e Referência; 2003. 206 p. Available from: https://pesquisa.bvsalud.org/portal/resource/pt/lil-488879?lang=en

[19] Kantor LS, Lipton K, Manchester A, Oliveira V. Estimating and Addressing America's Food Losses. Food Rev - Econ Res Serv USDA [Internet]. 1997;1–11. Available from: https://endhunger.org/docs_hunger/USDA-Jan97a.pdf

[20] ReFED (Rethinking Food Waste through Economics and Data). Restaurant Food Waste Action Guide [Internet]. 2018. Available from: https://refed.org/downloads/Restaurant_Guide_Web.pdf

[21] ReFED (Rethinking Food Waste through Economics and Data). A Roadmap to Reduce U.S. Food Waste by 20 Percent [Internet]. 2016. Available from: https://staging.refed.org/downloads/ReFED_Report_2016.pdf

[22] Wansink B, Johnson KA. The clean plate club: about 92% of self-served food is eaten. Int J Obes [Internet]. 2015 Feb 20;39(2):371–4. Available from: https://www.nature.com/articles/ijo2014104

[23] Wansink B, van Ittersum K. The Visual Illusions of Food: Why Plates, Bowls, and Spoons Can Bias Consumption Volume. FASEB J [Internet]. 2006 Mar 6;20(4). Available from: https://onlinelibrary.wiley.com/doi/10.1096/fasebj.20.4.A618-c

[24] Cohen JFW, Hecht AA, Hager ER, Turner L, Burkholder K, Schwartz MB. Strategies to Improve School Meal Consumption: A Systematic Review. Nutrients [Internet]. 2021 Oct 7;13(10):3520. Available from: https://www.mdpi.com/2072-6643/13/10/3520

[25] Müller PC, Oliveira ABA de. Avaliação de desperdício de alimentos na distribuição do almoço servido para funcionários de hospital público de Porto Alegre – RS. Curso de Graduação em Nutrição, Faculdade de Medicina, Universidade Federal do Rio Grande do Sul. 2008;33. Available from: https://www.lume.ufrgs.br/bitstream/handle/10183/16556/000699412.pdf?sequence=1&isAllowed=y

[26] Augustini VC de M, Kishimoto P, Tescaro TC, Almeida FQA de. Avaliação do Índice de Resto-ingesta e Sobras em Unidade de Alimentação e Nutrição (UAN) de uma Empresa Metalúrgica na Cidade de Piracicaba/SP. Simbio-Logias [Internet]. 2008;1(1):12. Available from: https://www.ibb.unesp.br/Home/ensino/departamentos/educacao/avaliacao_indice_resto-ingesta.pdf

[27] Moura PN de, Honaiser A, Bolognini MCM. Avaliação do Índice de Resto Ingestão e Sobras em Unidade de Alimentação e Nutrição (U.A.N.) do Colégio Agrícola de Guarapuava (PR). Rev Salus [Internet]. 2009;3(1):71–7. Available from: https://revistas.unicentro.br/index.php/salus/article/view/702/1158

[28] Amorim FP de, Gatti RR. Avaliação do índice de resto-ingesta e sobras em unidade de alimentação e nutrição de escola estadual com regime de internato na cidade de Guarapuava – Paraná. Fac Nutr Univ Estadual do Centro-Oeste UNICENTRO [Internet]. 2010;13. Available from: https://silo.tips/downloadFile/fabiano-patric-de-amorim

[29] Mello, Aline Gomes de Back F da S, Baratta R, Pires, Luciana Almeida Colares LGT. Avaliação do desperdício de alimentos em Unidade de Alimentação e Nutrição localizada em um clube da cidade do Rio de Janeiro. Hig Aliment [Internet]. 2011;25(200/201):33–9. Available from: https://higienealimentar.com.br/wp-content/uploads/2019/07/REVISTA-200-201.pdf

[30] Aranha FQ, Gustavo AFS e. Avaliação do Desperdício de Alimentos em uma Unidade de Alimentação e Nutrição na Cidade de Botucatu, SP. Hig Aliment [Internet]. 2018;32(276/277):5. Available from: https://docs.bvsalud.org/biblioref/2018/04/882814/276-277-site-28-32.pdf